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Could 'Lean Lite' Be The Cost Effective Solution To Applying Lean Manufacturing in Developing Economies?

The research follows a case study based on work in Pakistan carried out by The Institute of Productivity and managed by the United Nations Industrial Development Organisation (UNIDO). This paper examines a consultancy project with a Fan Manufacturer in Pakistan and identifies issues where lean manufacturing was seen as a logical improvement opportunity in a developing economy but where for reasons mostly related to resources in terms of time and financial contribution a traditional lean implementation was not appropriate. The conclusion goes on to suggest that the methodology adopted by the team, in this case termed Lean Lite could be applied in other situations where, for whatever reasons resource availability is limited as well as considering some of the mechanisms that are being used to make Lean Manufacturing more accessible to the SME in a developing economy.

Lean Manufacturing has become a standard response to the diverse pressures being exerted on the world's manufacturing companies (Furlan *et al* 2011, Vamsi *et al* 2014). As most operations academics and practitioners are aware the basic concepts of the lean approach emerged in the 90's, several authors (Womack and Jones 1996, Liker 1998) were amongst the first to document the journey as manufacturers in the main sought to eliminate waste from their processes. More recently the benefits of adopting a lean approach have become almost universally accepted within manufacturing and more recently in the services sector. Lander and Liker (2007) for example have documented the performance benefits of adopting the tools inherent in lean manufacturing, going on to suggest that there are financial savings to be made. Although there are variations in the lean approach it can summarised by two main tenets; the elimination of all waste from a process such that it runs using less resource and the establishment of a predictable flow for each process that matches the requirements of the customer (Wilson 2009).

As the world's manufacturing centers have relocated to developing economies to gain commercial advantage, so the concepts and application of lean manufacturing have followed. Several authors (Awni 2014, Ghosh 2012, Morosan 2011) have discussed the adoption of the technique within the manufacturing industries of developing economies. The consensus they *ibid* maintain is that the approach has a positive impact although there are differences in the identification of the most significant influencing factors on this success. However, the implementation of a true lean culture can be both time consuming and resource intensive (Wilson 2009, Begam et al 2013) moreover Begam goes on to postulate that often the incentives are not seen in the developing economy either by local management or the indigenous workforce.

The concepts of lean are often credited to the Toyota Production System (TPS) and more specifically to the work of Taiichi Ohno who spent several years as the chief engineer at Toyota. The approach was originally developed just after the Second World War when the Japanese economy was weak and many Japanese companies were forced to look at how to produce with minimal resources. The response from Toyota was to develop TPS. (Ohno 1988). .By the early 1960's Toyota had developed a workable lean approach (Womack *et al* 1990), this coincided with the loss of competitive advantage in the United States of America's car industry as the benefits of mass production were initially copied and then refined by the rest of the world, initially in Europe but later and with increasing success the growing economies of the East, particularly in Japan. Progressively through the late 70's and early 80's the car manufacturers of the US and Europe started to adopt their own interpretations of what they understood of TPS. These approaches were often limited to companies adopting specific tools associated with the overall lean approach, for example Statistical Process Control (SPC) or Single Minute Exchange of Die (SMED) predicated on what they perceived as the most

important element of the overall concept (Monden 1983).As companies in developed economies started to adopt these elements of TPS so they started to understand that the approach was not solely the application of a limited set of tools but was more fundamentally the application of a set of underlying principles or rules (Spear and Bowen 1999) and that the application of these rules was facilitated by a toolkit of practices which collectively led to an holistic lean approach (Shah and Ward 2003). More recently many authors (Jayram *et al* 2008, Nambiar 2010) have tried to distill the whole TPS ethos into lessons that other companies can learn to implement their own lean production system.

The Application of Lean in Developing Economies

The manufacturing powerhouses of the world have moved from the developed economies of the West, particularly the US and Europe, to the world's developing economies, particularly those in Asian and the Indian subcontinent. The relocation of manufacturing to developing nations has to an extent been matched by the spread of the lean philosophy. Many of the manufacturing sectors within these emerging economies are adopting a lean approach and there is evidence of many successful implementations in several industry sectors (Dangavach and Deshmukh 2005, Eswaramoorthi *et al* 2011). However the pace of change in many of these manufacturing economies is slow (Begam *et al* 2013) and there is evidence that this could be attributed to management's perception both of the impact that implementation will have on limited resources and a concern about the attitude and culture of the work force. There have been several responses to the need to start to address global competition by these emerging economies using the philosophy and techniques inherent in the lean approach. In China although the Chinese Government originally actively subsidised raw material costs to protect the developing manufacturing sector (Norman 2008) there has been a more recent move to encourage companies to embrace lean in order to become more directly competitive (Morosan 2011). In other emerging manufacturing sectors governments have started to use concepts such as national productivity organisations to attempt to drive forward the lean agenda

often trying to leverage funding from international sources (WCPS 2012). These National Productivity entities then become repositories for the training and development knowledge of a particular country helping to foster good practice within the manufacturing companies in their economy.

Pakistan's Economy and Manufacturing

Since 2007 Pakistan's GDP growth has steadily risen from a 0.4% increase in 2007/8 to a 4.14% increase in 2013/14, (Pakistan MOF 2014). While these figures are above the equivalent global GDP growth rates they are below those recorded by Pakistan's neighbours that of India, Bangladesh and Sri Lanka. Obviously there are many factors influencing this improving growth trend, not least the state of the global economy, but the government of Pakistan has identified manufacturing as one of the main planks of this and future economic growth. In 2013/14 the manufacturing sector in Pakistan accounted for over 13% of total GDP, the majority of this was large scale manufacturing which in turn was dominated by the textile industry. The textile industry remains Pakistan's largest exporter, nearly 2% of all global textile and clothing exports come from Pakistan, however this figure has not substantially changed in the last 10 years and there is evidence that it will actually reduce as China starts to leverage its growing clothing manufacturing base (WTO 2014).Pakistan has identified other manufacturing sectors as the target for growth and has developed strategies to support the improvement in the technology and skills within these sectors. Towards this objective the government of Pakistan has worked with many agencies for example the United Nations Industrial Development Organisation (UNIDO) on their "Triple Bottom Line" project in S.E. Asian (UNIDO 2003).

In 1961 Pakistan was one of eight founding members of the Asian Productivity Organisation (APO) and in 2001 established its own National Productivity Organisation (NPO) which was incorporated as a non-profit company in 2006

(NPO 2012). This organisation has the mission to “facilitate and enhance the productivity with quality and innovation by introducing and implementing programmes/initiatives in Pakistan.” (NPO 2012) The case study presented was carried out as part of one of these initiatives.

Case Study:

The case study presented examines a project that was implemented by The Institute of Productivity and managed by the United Nations Industrial Development Organisation (UNIDO). The overall objective of the initiative was designed to help improve aspects of Pakistan's manufacturing industry. It must be noted that the Institute of Productivity has a particular focus on social productivity, using productivity to create social impact much of the support therefore takes place in developing countries (Heap and Dillon 2012).

Initial research into Pakistan’s manufacturing sector by the Institute of Productivity consultancy team suggested that in many areas the technology and systems being used were well behind the main international competitors. In particular manufacturing practices were not equivalent to those prevalent in more established locations. This was especially true in the way employees were treated both in general human resource management terms including working practices and payment structures as well as with respect to health and safety procedures, these limitations also extended into the environmental focus of the organisations. The initial assessment and feasibility study led to the conclusion by the consultancy team that the optimum solution was likely to involve a number of actions including general business controls and targeted improvement initiatives but that a major factor in any overall strategy would have to be the adoption of some sort of lean approach. It was important that the concepts inherent in this philosophy informed the way Pakistani manufacturers viewed their operational improvement actions. The impact of the need to supply into international markets should not be underestimated

and the program involved work in assisting companies to interpret and comply with international standards. This paper will however concentrate on the specific actions undertaken in association with the development of a lean approach.

The need for the development of a lean approach was as a result of what the team described as the creation of “Trade Corridors” or mechanisms for building trust between potential Pakistani exporters and the likely importers within the target markets. In order to build this trust the importers have to have confidence in the ability of the producer to meet their likely requirements both in terms of volume and cost. The Institute of Productivity therefore had to address issues associated with improving capacity and developing performance improvements to ensure competitiveness of the specific exporting industry sectors. As has been identified a proven approach across developed economies to achieve this type of improvement is the adoption of a Lean approach.

It quickly became apparent to the team that most of the companies within the sectors of interest had limited financial resources to support any improvement initiatives, nor the control and reporting systems that would be needed. This situation was compounded by the fact that there was very little experience of lean suggesting that any implementation would therefore be lengthy and expensive the very things that the companies supported by the project could not afford. Yet the benefits of implementing a lean approach are well documented and the engagement in such an approach would demonstrate commitment and help the trust building process required to develop the “Trade Corridor”. The adopted solution was to develop a ‘sub-set’ of lean techniques still based on the same lean principles but requiring significantly less investment. To give the initiative more longevity and to reduce future reliance on external agencies it was also decided to work alongside the National Productivity Organisation (NPO) of Pakistan. The limited timescale of the initial project [the funding had been approved for 3 years] meant that

this was the only mechanism available to create some momentum and generate internal capacity so that this improvement and the ability to apply the principles of lean manufacturing could continue after the involvement of the external consultants had ended.

The first phase of the project was to undertake measurement of the current situation, this approach is often used to base line the existing process particularly important when trying to demonstrate improvement and especially so if there is an external funding agency to whom the investment must be justified, in this case the European Union. A good understanding of the macro and micro environment was useful in helping to shape any interventions and also to identify customer requirements both now and likely potential future needs. As part of this process the Institute of Productivity worked with a 'national expert' and with members of the Pakistan NPO to measure the performance of the sector and benchmark against its major international competitors. The exercise then compared the performance of individual firms in the sector; this allowed a comparison with both the sector average and against the 'best in class within Pakistan'. The measurement included a range of performance factors for each company but particular emphasis was placed on overall equipment effectiveness (O.E.E.) which despite the difficulties of comparing such a measure across different organisations is widely understood and used. The development of a standard mechanism for measurement of OEE allowed it to be used as a kind of 'summary measure' which could then be used for ease of comparison.

A stakeholder analysis was also carried out this process identified individuals and groups who were affected by the project and who could influence the success or failure of the initiative. These included a number of government agencies responsible for different aspects of support for industry including training providers and small medium enterprise (SME) support within the sector. In addition to the usual identification of stakeholders and their needs the exercise was also used to try and gauge the receptiveness of specific individuals, usually company owners and senior managers to the concepts

inherent in the change. Once identified all key stakeholders were then involved in any meetings and subsequent plans to gain co-operation.

The second phase of the project identified a group of individuals representing the key stakeholders who would be trained in 'Lean Lite' and then undertake improvement studies in a selected industry sector. As part of the collaboration with Pakistan's NPO this group included several people from that organisation, the intention was that by using these individuals as part of this initial training the objective of sustaining the initiative could be met as they could take the concepts into other sectors. The industry sector chosen for this initial stage was the manufacture of electric fans. Fan manufacturing is concentrated in Gujrat and this concentration made it relatively easy for the project team to visit a large number of firms in a comparatively short space of time. Eventually through discussions with the local employer's association and as a result of some of the initial stakeholder analysis a single company was selected to be the subject of the initiative. The owner of this company was active in the association and was also willing to disseminate the resulting operational changes with the other members of the association. Importantly he [the owner] was one of those identified as being "receptive" to the concepts of change, so while individual actions would still have to be justified there was a general feeling that just establishing the need for changes would not be a significant issue.

The Institute of Productivity had designed a curriculum for the Lean Lite training and had prepared training materials including student handbooks and exercises. The training was delivered over an intensive 3 day programme; although the course was referred to as "Lite" the tools and techniques covered were thoroughly explored. The term 'Lite' was used to refer to the fact that the training had been "stripped down" to 3 core elements of the lean

philosophy, the training then concentrated on explaining these concepts and detailing the core tools that would be used to assist each company in the implementation of these concepts. The three core concepts were:

1. Waste: Looking at customer requirements and maximising all the activities that are associated with providing this, since this is providing value for the customer these steps are traditionally referred to as value added and minimising activities that do not add value, anything for which the customer does not pay.
2. Flow: The movement of material within the factory is itself a non-value adding process, but the need to control the flow of material is paramount to facilitating many of the controls needed to support waste minimisation for example matching flow to customer requirements to eliminate finished goods stock and matching internal production rates to eliminate in process stocks.
3. Involving the workforce: Using the workforce's experience and expertise in both identifying potential improvements opportunities and developing appropriate solutions. This issue had particular cultural significance given the traditional relationship between management and workers within Pakistan.

The training was based on a mixture of traditional taught sessions where an instructor would impart knowledge followed by a number of student centered activities which allowed the students to practice the application of the techniques in a classroom situation and receive formative support from the tutor. An important part of the course was that the students were immediately able to apply these tools in their workplace in Gujrat and then return to the classroom to evaluate how well the application had proceeded and receive further formative feedback from the facilitator. This ability to mix the theoretical, practical and analytical was an important element of the training. The programme commenced in March 2012.

Results:

As a direct result of the initial training, the fan manufacturer received 27 improvement suggestions from the workforce. The simplest ideas, the type often termed “quick wins”, could be implemented almost immediately, for example one of these was for the use of a ratchet screwdriver during the securing of the blades to the fan which as well as reducing the time to complete that stage of assembly also reduced the risk of injury. The more significant ideas made more fundamental changes to cycle time and quality aspects of the operation, even in what was a comparatively new factory suggests were made in the layout to improve the flow of material. It could also be argued that the most significant change resulting from the training was that the workforce had been engaged and included in the identification of problems and the generation of improvement suggestions; this was the first time that they had had a significant input into this process. The impact on their morale and well-being was substantial and it was clear that their new found appetite for involvement could form the basis of effective, future kaizen activities and projects.

The impact on the factory was significant with the targeted production being produced in a substantially shorter portion of the working week. The financial impact was generated by two main factors; firstly a large saving in energy costs, this element also had an environmental impact. The second was a reduction in the work in progress within the factory which led to a drop in the owner’s working capital. The ability of the workforce to contribute to problem identification also allowed them to raise issues with the work practices used in the factory which in turn had a positive impact on the injury rate.

As well as assisting with the identification of some improvement suggestions the Institute of Productivity also discussed with the owner how the gains from the improved manufacturing process might be shared with the overall workforce. It was agreed that as the owner did not believe there was

sufficient market potential for any additional sales then in order to realise the savings in labour and energy costs the company would operate for three days for each week and use the other two days as an educational establishment to train their workforce in additional skills including English and basic numeracy which would not only benefit production but also the wider community.

The benefits of this project can be seen to stretch across the three dimensions of the SEE (Societal, Environmental, Economic) model, there has been significant work done on the use of this model to measure how well improvements are contributing to improvements in quality of life (Burgess and Heap 2012), and by ensuring this project produced benefits in all these aspects the initiative was able to demonstrate it was contributing to UNIDO's overall objectives. It could be argued that to help the 'Lean Lite' improvements to fully benefit the company and thereby the wider economy that more training on market drivers could be included within the training. The relationship between business improvements and the use made of them within the marketing message has been identified as an area that most companies neglect (Chaplin and O'Rourke 2014) and this is something that could have been supported by the project consultants especially in the wider supply chain.

Conclusion.

The benefits of Lean Manufacturing are widely understood and the approach has been applied to industry sectors well away from its manufacturing origins (Laureani 2012, Bateman et al 2014). The concepts are moving around the world as manufacturers in developing economies seek to move to compete on the international stage. The major obstacles to the implementation of the approach in smaller businesses in developing economies appears to be a perception that the approach is expensive, requiring a great deal of support delivered over a long time period, and the benefits dubious, as in the case study many small companies may not be able to take full advantage of the

reduced resource requirement or increased capacity that may result. A factor that future projects could address by considering the marketing aspects of any likely improvements. The belief that lean is difficult to implement has particularly been fostered by western consultants keen to demonstrate to their clients and prospective clients that they provide valued (Wilson 2009). The reputation of lean as a people reducer is also seen as acting against its implementation in situations where labour is already cheap; frequently the reason manufacturing initially took off in these target economies. The mechanisms that can be used to attempt to refute these views are the development of approaches that require less investment in both time and money while illustrating that lean is far more than people reduction.

The development of the “Lean Lite” approach it is argued addresses both of these concerns. It must be noted however that the approach is not a substitute for a full lean program; in fact for many large companies in developed economies an attempt to do some form of ‘Lean Lite’ implementation may be counterproductive. It is a specific tool to address a specific problem and in particular starts to breakdown some of the systems inherent in small businesses in areas without any experience of modern manufacturing. The steps to a full lean organisation outlined by Womack and Jones (1996) still need to be applied but it is understanding the significance of the 5th step that allows initiatives such as “Lean Lite” to add value to those organisations who cannot support for whatever reason a full lean programme. Traditionally viewed as “striving for perfection by continually removing waste” this 5th step basically allows you to take your initially improved leaner process and start again. Admittedly you probably won’t need to identify your customer requirements every time but you may at stages move from customer needs to those things that delight them. As each cycle is completed so the underlying concepts become more embedded and the status quo can be challenged in a covert way. It is of course important that the continuous improvement ethos is a key element of the training to ensure it actually happens. It is only in this

way that the approach can avoid being a “one hit wonder”, implemented to obtain a specific improvement and then forgotten. This is where this project can reap the rewards of having shown the workforce that they have a role to play in continuous improvement and that their contributions to such improvement can have benefits for them as well as the business.

The concept of maximizing the use made of resources is not solely limited to the monetary value of those resources; the financial cost is not the only price that has to be paid for the majority of resources used in the manufacturing process. Similarly and as partially indicated in the case study the benefits of improving the utilisation of the human resource can lead to more positive outcomes particularly where the workforce does not enjoy many of the benefits expected by workers in the more developed employment locations around the world. The ability to link any improvements provided by the lean approach to these positives is vital in overcoming any suspicion in the minds of the workforce. Traditionally business improvements are linked to security of employment and occasionally some financial rewards often in the form of bonuses. This linkage of company benefits to individual gain can be continued through applications such as “Lean Lite”, but the rewards are more associated with fundamental benefits rather than purely financial.

This project has demonstrated that a relatively small amount of training that is focused on the core factors that underpin the Lean methodology (Waste, Flow respect for People) can have significant impact. It also demonstrates that a focus on social benefits for the community involved in the change alongside financial benefits for the business might be a stronger motivating factor in some societies where otherwise a simple focus on business improvement might lead to a key stakeholder group (the employees) being excluded from a share of the gains. Business owners who are encouraged to offer social benefits in return for employee participation might see the benefits of adopting this ‘win-win’ approach and incorporate their new-founds sense of social responsibility into their future decision-making and business planning. It might also be worth noting that the societal benefits gained from adopting a ‘Lean

Lite' programme may ultimately help the SME in the developing nation become much more attractive to a Western organisation looking to improve their own CSR policy in terms of their supply chain, thus gaining competitive advantage for the SME engaging with lean concepts.

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